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PATENT APPLICATION OF

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ENTITLED

PORTABLE AIR COOLING SYSTEM

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PORTABLE AIR COOLING SYSTEM

The present application claims the benefit of U.S. provisional patent application Serial No. 60/400,165, filed July 31, 2002.

FIELD OF THE INVENTION

The present invention generally relates to an environmental control system, and more particularly, to a portable environmental control system for use with portable personal shelters.

BACKGROUND OF THE INVENTION

Portable personal shelters used for outdoor activities include tents, tent trailers (pop-up trailers), boat cabins, and other portable personal shelters. Portable personal shelters are typically capable of providing ventilation to allow outside air inside the enclosure. Even so, the air in such portable personal shelters during the summer can be hot, humid and contain air pollutants, such as pollen and dust. As a result, it can become very uncomfortable within the portable personal shelter.

There exists a need for a system that provides environmental control of a portable personal shelter including an ability to modify the temperature and humidity of the air, and the ability to remove air pollutants.

SUMMARY OF THE INVENTION

The present invention is directed to a portable cooling system for use with a portable personal shelter to provide control of the environment within the shelter relative to the outside. The portable cooling system includes an air cooling unit, a housing enclosing the air cooling unit, an output port, and flexible tubing. The air cooling unit includes an air intake, an air cooler, an air output, and a blower. The blower is configured to drive air from the outside through the air cooling unit. The air cooler is configured to cool air received through the air intake. The cooled air is then discharged through the air output by the blower. The output port is connected to the air output for receiving the cooled air. The flexible tubing includes a first end that is coupled to the output port and can be used to deliver the cooled air to a portable personal shelter.

Other features and benefits that characterize embodiments of the present invention will be apparent upon reading the following detailed description and review of the associated drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a portable personal shelter system in accordance with embodiments of the invention.

FIG. 2 is an example of a portable personal shelter system in accordance with embodiments of the invention.

FIG. 3 is an interior view of the portable personal shelter of FIG. 2.

FIG. 4 is a schematic diagram of a portable cooling system in accordance with embodiments of the invention.

FIG. 5 is a side plan view in partial cross-section of a portable cooling system in accordance with embodiments of the invention.

FIG. 6 is a magnified view of the system of FIG. 5 contained within circle 6.

FIG. 7 is a partial perspective view of a portable cooling system in accordance with embodiments of the invention.

FIG. 8 is a perspective view of a portable cooling system in accordance with embodiments of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a schematic diagram of a portable personal shelter system 100 in accordance with embodiments of the invention. System 100 generally includes a portable cooling system 102 and a portable personal shelter 104. Shelter 104 generally includes exterior walls 106 that define an interior chamber 108. Examples of portable personal shelters 104

include tents, tent trailers or pop-up tents, boat cabins, and other portable personal shelters.

Portable cooling system 102 is located outside of shelter 104 and is configured to deliver cooled air into interior chamber 108, as indicated by arrows 110 and 112. In general, portable cooling system 102 receives air that is exterior to portable shelter 104, cools the air, and delivers the cooled air into chamber 108 of shelter 104. In this manner, the environment within shelter 104 can be maintained at a cooler temperature than the environment outside shelter 104. Additionally, the cooled air delivered to chamber 108 by portable cooling system 102 will also generally have a lower humidity than the air outside of shelter 104 as a result of the cooling of the air.

Portable cooling system 102 can be powered by a power supply 114. Power supply 114 can be a portable generator or a fuel cell. An example of a suitable portable generator is the Honda EU1000 generator. Alternatively, when available, portable cooling system 102 can receive power from a standard line level power receptacle, such as those that are commonly available at campsites. Power supply 114 can also be formed as a component of portable cooling system 102.

FIG. 2 is an example of a portable personal shelter system 100 in accordance with various embodiments of the invention. Shelter 104 is in the

form of a tent that includes a front wall 116, side walls 118 and 120, a rear wall 122, and a bottom 124 which define an interior chamber 108, as shown in the interior view of shelter 104 of FIG. 3. Shelter 104 includes an input port 126 that is coupled to exterior wall 116. Input port 126 includes an opening 128 (FIG. 3), through which interior chamber 108 is accessible from the outside. Portable cooling system 102 includes an air output 130 through which cool air is discharged. Flexible tubing or an air duct 132 joins air output 130 to input port 126 and delivers cooled air discharged through output 130 into interior chamber 108 of shelter 104.

A more detailed discussion of portable cooling system 102 will be provided with reference to the schematic diagram of FIG. 4. In general, portable cooling system 102 includes an air cooling unit 140, a housing 142 that includes an interior chamber or compartment 144 that encloses the air cooling unit 140, the output port 130 and the flexible tubing 132.

Air cooling unit 140 includes an air intake 146, an air cooler 148, a blower 150, and an air output 152. Blower 150 is configured to drive air into air intake 146 as represented by arrows 154 and 156, drive the air through air cooler 148 as represented by arrow 158, and drive the air through air output 152, as represented by arrows 160 and 162. Air intake 146 receives air 154 and 156 from the outside, which is then fed to air cooler 148. Air cooler 148 is

configured to cool the air and output cooled air 158. The cooled air is then discharged through air output 152 by blower 150 and through output port 130. Flexible tubing 132 receives the cooled air 162 from output port 130 for delivery to a portable personal shelter 104, such as the tent depicted in FIG. 3. One suitable air cooling unit 140 is the Daewoo Model No. 267566, which has a capacity of 5200 BTU/(h)(hp). Other types of air cooling units, such as compressor-less air cooling units, can also be used.

Air cooling unit 140 can also include a controller 164 that is configured to control the operation of air cooling unit 140 in response to one or more inputs. The inputs can come from a control panel 166, which generally includes input buttons (not shown) for activating the power and controlling various settings of air cooling unit 140. Alternatively, air cooling unit 140 can include an infrared receiver 168 that is configured to receive input signals from a remote control 170 which can be processed by controller 164. Controller 164 then controls the operation of air cooling unit 140 in accordance with the input signals from remote 170.

Air cooling unit 140 can also include a display 171 for providing information to a user, such as blower speed (e.g. high or low), temperature settings, and other information. In accordance with one embodiment of the invention, display 171 is

formed as a component of control panel 166, as shown in FIG. 4.

In accordance with another embodiment of the invention, portable air cooling system 102 includes a temperature sensor 172 that generates an output signal 174 that is indicative of a temperature of interior chamber 108 of portable personal shelter 104. Output signal 174 is provided to controller 164, which can regulate the operation of air cooling unit 140 as required to maintain a temperature of interior chamber 108 at a desired level. Temperature sensor 172 can be a thermocouple, a resistance temperature device (RTD), or other suitable temperature sensor. Temperature sensor 172 is preferably supported within interior chamber 108 at a location that is suitable for effectively measuring the air temperature of interior chamber 108, as shown in FIG. 3. Temperature sensor 172 can be directly connected to air cooling unit by a suitable cable 176, or configured to wirelessly provide output signal 174 to controller 164.

Housing 142 generally encloses air cooling unit 140 and other components within a first chamber 144, as mentioned above. First chamber 144 is preferably waterproof. Housing 142 also includes multiple vents, such as vent 180, shown in FIG. 4, to allow heat to escape from within first chamber 144. The vents are preferably configured to prevent water from entering chamber 144. Additional vents can be provided

adjacent air intake 146 and air output 152 of air cooling unit 140, such as vents 182 and 184, respectively. Housing 142 can also provide support for the output port 130 adjacent air output 152. Housing 142 can also include additional compartments, such as compartments 186 and 188, for storage of tubing 132 and other components of portable cooling system 102. Housing 142 can also be configured to contain power supply 114.

The walls defining first chamber 144 and compartments 186 and 188 can be formed using rigid or semi-rigid materials, such as plastic and other durable materials suitable for luggage products. Alternatively, the walls of housing 142 can be formed of fabric, as illustrated in the side plan view of portable cooling system 102 of FIG. 5. The fabric is preferably durable and substantially water-resistant, such as Gortex. First compartment 144 in which air cooling unit 140 is contained preferably is accessible through a removable cover 190. Likewise, compartments 186 and 188 are preferably sealable in accordance with conventional methods.

One embodiment of housing 142 includes a rigid base member 192 for support of air cooling unit 140, as shown in FIG. 5. Housing 142 also preferably includes handles, such as handle 194 and 196. In accordance with one embodiment of the invention, handle 196 is extendible as indicated by the phantom depiction of handle 196 at 196'.

In accordance with another embodiment of the invention, portable cooling system 102 includes wheels 200, as shown in FIGS. 2 and 5. Wheels 200 preferably mount to rigid base member 192 on a side that is opposite handle 196 (FIG. 5). Wheels 200 can be small wheels that rest substantially underneath housing 142. Alternatively, wheels 200 can be large wheels having a diameter of approximately greater than 3 inches, such as those depicted in FIG. 5. The large wheels 200 allow for easier transport of portable air cooling system 102 over rough terrain. Additional wheels can be added to rigid base member 192 to further assist in the transport of portable cooling system 102.

As mentioned above, output port 130 receives discharged cool air from air output 152 of air cooling unit 140. Output port 130 is also configured to receive an end 202 of flexible tubing 132 as illustrated in FIG. 4. One embodiment of output port 130 includes a sleeve member 204 that includes a first end 206 that is positioned adjacent air output 152 of air cooling unit 140 and a second end 208 having a connector portion 210 that is configured to receive the end 202 of flexible tubing 132, as shown in FIG. 6, which is a magnified view of the portion of portable cooling system 102 contained within circle 6 of FIG. 5. In accordance with one embodiment of the invention, the connector portion 210 includes a drawstring that is attached to sleeve 204 adjacent

to end 208. A portion of drawstring 212 is preferably supported within sleeve 204 at end 208 such that end 208 becomes constricted as the ends of drawstring 212 are pulled. Drawstring 212 can then be secured in a conventional manner with an appropriate clip 214, as illustrated in FIG. 7. Connector portion 210 of output port 130 can also be a fitting or other suitable component for interfacing end 202 of flexible tubing 132.

Sleeve 204 can be secured to housing 142 adjacent air output 152 of air cooling unit 140 by various methods. In accordance with one embodiment of the invention, output port 130 includes a front plate 216 and a rear plate 218, which receive a portion of a side wall 220 of housing 142 and a portion of sleeve 204 therebetween. Suitable fasteners 222, such as nuts and bolts, screws, rivets, etc., squeeze front plate 216 and rear plate 218 together thereby pinching side wall 220 of housing 142 and sleeve 204 therebetween to complete the mounting of sleeve 204 to output port 130. Sleeve 204 can also be attached to output port 130 using other methods, such as by using glue, or by sewing sleeve 204 to side wall 220 of housing 142, for example.

In accordance with one embodiment of the invention, housing 142 includes a flap 224 adjacent output port 130, as shown in FIG. 7. Flap 224 is configured to close output port 130 when output port 130 is disconnected from tubing 132, as illustrated

in FIG. 8. Additionally, flap 224 can be configured to enclose sleeve 204 of output port 130 when it is not in use. Flap 224 is preferably secured in a closed position, as shown in FIG. 8, using Velcro® or other suitable fastener.

The input port 126 of portable personal shelter 104 can be formed similarly to output port 130 described above. Accordingly, input port 126 can include a sleeve member 230 that is attached to one of the exterior walls 106 of portable shelter 104, such as front wall 116, as shown in FIG. 2. Sleeve 230 also preferably includes a connector 232 that is configured to receive a second end 234 of flexible tubing 132. Connector 232 can be a drawstring type connector, such as that described above, or other suitable connector.

Portable cooling system 102 can also include a filter 250 that is configured to filter the air that is delivered to portable personal shelter 104, as shown in FIG. 4. Air filter 250 operates to remove pollutants from the air that is provided to portable personal shelter 104, such as pollen and dust. Filter 250 can be positioned either adjacent air intake 146 (FIG. 5) or adjacent to air output 152, such that the air flow passes through air filter 250 prior to its delivery to portable personal shelter 104. One embodiment of air filter 250 is an electrostatic air filter. Other types of air filters can also be used.

Flexible tubing 132 is preferably formed of collapsible air duct, which allows tubing 132 to be contained within a compartment of housing 142, such as compartment 186 or 188. Flexible tubing 132 is also preferably insulated by an insulating sleeve 252 as shown in FIGS. 2 and 6. The insulating of flexible tubing 132 prevents the heating of the cooled air traveling therein and can also prevent condensation on tubing 132.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.